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IMPLEMENTATION OF FOREST-RELATED DECISIONS OF THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT AT THE NATIONAL AND INTERNATIONAL LEVELS, INCLUDING AN EXAMINATION OF SECTORAL AND CROSS-SECTORAL LINKAGES

Programme Element I.2: Underlying causes of deforestation and forest degradation

Report of the Secretary-General

SUMMARY

Deforestation and forest degradation pose a serious problem in some parts of the world, but not all changes in forest cover are necessarily harmful. It is preferable to adopt a more focused approach that concentrates on reversing the most damaging processes and promoting the most effectively beneficial ones. It is only possible to decide what changes are or are not harmful against a background of national policies that make a best judgement of optimum forest cover (how much, where and of what kind) in order to meet most effectively diverse needs for forest goods and services. Policies for forests (and trees outside forests) need to be consistent with overall economic, land-use and development policies.

Current international trade apparently offers few incentives for sustainable extraction. Moreover, there are many direct disincentives for sustainable forest management, including economic distortions, such as the undervaluation and underpricing of particular types of timber and of the services provided by healthy forest ecosystems; the failure of national institutions to exercise stewardship over their forest resources; prevailing systems of property rights; the conditions under which concessions are awarded and renewed; and inequities in the distribution of benefits.

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The evidence available suggests that the underlying forces driving deforestation and forest degradation are complex. Simplistic explanations that blame deforestation on high population growth rates in developing countries, the demand for tropical timbers in the North, or pressures to meet debt repayments are inadequate and fail to provide conclusive answers applicable to a range of different circumstances. In fact, effects are synergistic and interconnected: cross-sectoral issues and the international linkages brought about by macroeconomic policies are both important determinants.

The links between harmful changes in forest cover and their direct and underlying causes are very complex, vary greatly from country to country and are not susceptible to simple explanations. There is therefore great danger in basing policy prescriptions on generalizations. Accordingly, the present report proposes a diagnostic tool that can enable countries to trace the chains of causation of deforestation and degradation, can identify limiting factors and opportunities for effective intervention, and can assist in identifying areas in which such limiting factors and interactions have been successful, thus enabling countries to build on their strengths and existing achievements.

Although relatively accurate statistics about changes in forest cover are available, there is a severe shortage of information about forest quality, which is particularly troubling since many of the most serious unplanned changes in forests concern quality rather than quantity.

The most appropriate action will be at any one of a number of levels, local, national, regional or international.

The need for communication and collaboration among relevant individuals, agencies and institutions in their different areas of operation is an important issue that needs to be addressed in order to rationalize the allocation of resources both nationally and internationally.

Some causes of deforestation and forest degradation lie outside the forest sector and beyond national boundaries; it is in such areas particularly that the Ad Hoc Intergovernmental Panel on Forests may wish to identify options and opportunities for international cooperation and action.

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INTRODUCTION

1. The present report covers element I.2 of the programme of work of the Ad Hoc Intergovernmental Panel on Forests, "Underlying causes of deforestation and forest degradation".

2. Preparation of the report was guided by the decisions of the Commission on Sustainable Development taken at its third session and further elaborated by the Panel at its first session.

3. The Commission defined programme element I.2 as a need to identify and consider ways to address the underlying causes of deforestation, forest degradation and the difficulties in implementing sustainable forest management, with particular attention to cross-sectoral factors, including the impact on and from forests, at the national and international levels, such as consumption and production patterns, poverty, population growth, pollution, terms of trade, discriminatory trade practices and unsustainable policies related to such sectors as agriculture, energy, and trade.

4. Subsequently, the Panel emphasized that preparation for the discussion of the issue would require the judicious consideration of an array of contributing factors, many of them of a cross-sectoral nature, and recommended that a report on the underlying causes and cross-sectoral influences on forest degradation and deforestation, and the difficulties in implementing sustainable forest management should be prepared, bringing together key work in the area and identify gaps.

5. The present report was prepared by the United Nations Development Programme (UNDP), as lead agency for programme element I.2, in consultation with the secretariat of the Panel in the Division for Sustainable Development of the Department for Policy Coordination and Sustainable Development of the United Nations Secretariat. The report is based on a study prepared by the Overseas Development Agency of the Government of the United Kingdom of Great Britain and Northern Ireland.

6. The report draws widely from a number of recent sources, including Forest Resources Assessment 1990: tropical countries, a publication of the Food and Agriculture Organization of the United Nations (FAO); The Forest Resources of the Temperate Zones, a publication of the Economic Commission for Europe (ECE) and FAO; country reports to the Commission, the India-United Kingdom initiative; the papers and conclusions of the Intergovernmental Working Group on Forests, which were co-sponsored by Canada and Malaysia; various initiatives in developing criteria and indicators for sustainable forest management, such as the Helsinki and Montreal processes; the work of International Tropical Timber Organization (ITTO) in the field of sustainable forest management; and the Bali consultation, which was co-sponsored by the Centre for International Forestry Research (CIFOR) and the Government of Indonesia.

I. GENERAL OVERVIEW

A. Objective

7. Many of the current changes to the world's forests are both serious and damaging, involving a loss of both quantity and quality, and every effort should be made to address the underlying causes to these damaging changes. But while the terms "deforestation" and "forest degradation" have been useful in drawing attention to the gravity of the situation, there is a danger in overemphasizing such terms, for they are value-loaded. By implication, they suggest that all replacement of forest by other uses is necessarily harmful and all reforestation is necessarily beneficial. They therefore tend to divert attention from a more focused approach, which would concentrate on reversing the most damaging processes and promoting those that would be most beneficial.

8. The emphasis of the present report will therefore be slightly different. It will describe the kinds of change that are now affecting the quantity and condition of all types of forests; it will seek to identify the causes of any detrimental changes; it will try to analyse why it is so difficult to implement sustainable forest management; and it will recommend ways in which all these may be improved. The report will also highlight the need to concentrate on keeping or developing forests in the right places for the right reasons. It is recognized that different sectors of global society have different needs and expectations for the use of forest land, and that such needs and expectations have changed in the past and will certainly alter further as development proceeds.

9. It would be much easier to work towards the better use of the world's forests if there were general agreement on the optimal extent and type of forest in different situations. While this consensus is being reached, there are in the meantime some difficult yet fundamental questions that could be raised by each country and which each could try to address by itself:

(a) How much forest should it retain for present and future needs?

(b) Of what kinds, and where?

(c) For what purposes should these forests be managed and for the benefit of whom?

(d) Are these decisions made on national grounds and in broad conformity with reasonable international responsibilities and obligations?

10. There is a corresponding and more difficult question to be answered at the regional level and by the international community, namely "Does the sum of national decisions make sense in global terms?"

11. If some reasonable consensus could be reached along these lines, it would then be possible to assess changes in forest quantity and quality, both nationally and internationally, against some yardsticks that make ecological, economic and social sense (see box 1).

12. Many of the issues raised in the present report will be addressed and deliberated on in detail by the Panel under other programme elements; thus, the outcome of other discussions is likely to have a direct influence on the development of the final recommendations of the Panel on programme element I.2.

Box 1. Assessing the consequences of forest change

While the extent and condition of a forest are ideally matters for accurate measurement, the assessment of whether any change in either quantity or condition is beneficial or harmful is largely a political judgement related to the circumstances of a particular time and place.

Nevertheless, there is some consensus that some changes are almost always harmful, such as severe pollution, serious soil erosion or loss of fertility, the elimination of key species and, generally, the replacement of a sustainable form of utilization by one that is unsustainable. In all such instances, the cost of restoration has been shown to be many times greater than the cost of prevention; indeed, it may ofter be technically impossible.

Moreover, some of the goods and services provided by forests are replaceable, while others are not. The functions of timber from natural forest can be performed by timber grown in plantations or by materials substituted for timber. Tree crops or grassland may, in some instances, provide as good catchment protection as forest. But the role of a particular forest in providing the living space and livelihood for an indigenous community or the biological diversity that it contains are not replaceable; such features are sometimes known as "critical natural capital".

B. Definitions

13. While several definitions are used, the most widely quoted and most authoritative figures on deforestation are contained in (a) the FAO publication Forest resources assessment 1990: tropical countries and (b) the ECE/FAO publication The Forest Resources of the Temperate Zones.

14. The definitions in these two sources differ. Publication (a) gives the following definitions:

(a) Forests are defined as ecosystems with a minimum of 10 per cent crown cover of trees and/or bamboos, generally associated with wild flora, fauna and natural soil conditions, and not subject to agricultural practices.

(b) Deforestation refers to change of land use with depletion of tree crown cover to less than 10 per cent. Changes within the forest class (from closed to open forest) which negatively affect the stand or site and, in particular, lower the production capacity, are termed forest degradation. Degradation is not reflected in the estimates.

15. Publication (b) gives the following definition:

(a) Forest is defined as land with tree crown cover (stand density) of more than 20 per cent of the area. Continuous forest with trees usually growing to more than 7 metres in height and able to produce wood. This includes both closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground and open forest formations with a continuous grass layer in which tree synusia cover at least 10 per cent of the ground.

16. These definitions have proved valuable in the assembly of standardized global statistics about changes in forest cover but are not so helpful for examining the nature and causes of change. For the purposes of the present analysis, therefore, the report employs the more neutral terms "replacement" and "modification" in place of "deforestation" and "degradation", except where the latter are clearly meant. These are defined as follows:

(a) Replacement: replacement of natural forest or other wooded land by another land use;

(b) Modification: forest modification, which may be regressive (degradation), or progressive (recovery or enhancement). Extreme degradation can of course lead to total forest loss.

17. For sustainable forest management, the Helsinki definition is used, namely:

"Sustainable management means the stewardship and use of forests and forest lands in such a way and at such a rate that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions at local, national and global levels and that does not cause damage to other ecosystems."

C. Forest values

18. The topic of forest valuation will be discussed in detail under programme element III.1, also scheduled for substantive discussion at the current session of the Panel (see E/CN.3/IPF/1996/6). However, it will be briefly discussed here because of its importance to the topic of the present report.

19. Trees and forests provide a range of benefits in the form of goods and services that arise from both direct and indirect uses of forest resources (see table 1). Direct uses include the extraction of useful products, such as timber, food and medicines, as well as non-extractive uses, such as recreation and tourism. Indirect uses include ecological and environmental services. In addition, the maintenance of healthy forests provides insurance by conserving the species that they contain and the goods and services that they can provide. These are sometimes referred to as option values, and they also reflect the future benefits that may accrue from the resources associated with forests and their uses.

Table 1. Values, goods and services provided by trees and forests

Use values		Non-use values	
Direct uses	Indirect uses	Existence values	Option values
<u>Extractive</u>			
Timber	Nutrient cycling	Threatened habitats	Future values of all use and non-use values
Genetic resources	micro-climate	Endangered species	
Plant medicines	Sink-filter for air pollution emissions	Charismatic species	
Non-timber products	Watershed protection		
<u>Non-extractive</u>			
Human habitat	Carbon storage		
Ecotourism			
Recreation			
Education			
Scientific/research			

20. The goods and services that forests may provide can be distinguished by the type of benefit that they produce (direct or indirect) or in terms of the distribution of the benefits (local, national, regional or global) and whether they pass through markets (see table 2).

21. There are two important characteristics to note about the goods and services and different uses of forests outlined here. First, in different types of forest some values will be more important than others; for example, some types of forest are especially valuable for the timber they produce, whereas others may yield important non-timber products. Second, there may be trade-offs or even conflicts between different uses; for example, a forest exploited for its timber may not have a high value for recreation or in an aesthetic sense.

22. The value and relative importance of the goods and services may also change both over time and in accordance with the different needs and development paths of countries and the emphasis that their Governments choose to put on the role of forests in the national economy.

Table 2. Market and non-market forest values

Values	Market	Non-market
Local	Locally sold forest products	Non-commercial forest products
National	Tourism revenues	Tourism benefits Watershed protection
International and global	Genetic resources currently used	Carbon sequestration Future genetic resource use Tourism benefits

II. CURRENT STATUS OF FORESTS

A. Nature and rates of change

23. Much has been written about changes in forest cover. The most authoritative recent statements are contained in the above-mentioned FAO and ECE/FAO publications on forest resources assessment. These are generally accepted and their details will not be repeated here; however, a recent aggregation of annual changes in forest cover by region from 1980 to 1990 is contained in table 3.

Table 3. Annual change of forest and other wooded land, by region, 1980-1990

Region	Annual change 1980-1990 (thousands of hectares)	Percentage of total cover
Africa	-2 828.0	-0.3
Asia and the Pacific	-999.0	-0.6
Latin America and the Caribbean	-6 047.0	-0.5
Europe	190.8	0.13
Former USSR	51.3	0.01
North America	-316.5	-0.11
Developed Asia/Oceania	-4.2	0
Total	-9 952.6	-0.2

Source: FAO, "Forest resource assessment 1990: a global synthesis", FAO Forestry Paper, No. 124 (Rome, 1995).

24. Regarding the above-mentioned standard assessments, however, it should be noted that:

(a) First, neither assessment includes any detail about the quality condition of forests;

(b) Second, the importance of broader forest functions is being increasingly appreciated;

(c) Third, the FAO assessment emphasises that the great majority of tropical countries have insufficient institutional capacity to collect and analyse data on a continuous basis.

1. Forest replacement

25. Forests in the form of ecosystems largely dominated by woody species can occur in any part of the world where the temperature and rainfall are suitable; there is little doubt that they once covered all areas that were not either too cold, dry or windy for tree growth. Forests have been removed and altered since the early days of human history, certainly since the Neolithic period.

26. The greatest replacement of forest for other uses occurred in parts of the world where organized agriculture was possible and that were agreeable and healthy for human settlement. In many of these, the forest has been severely diminished, notably in the Mediterranean, semi-arid, temperate and subtropical climates; in the steppe and prairie regions, the natural vegetation replaced was not forests but grassland. In equatorial climates, forest clearing was most marked on rich volcanic or alluvial soils with possibilities for irrigation. It is thus no accident that the largest areas of forest remaining at the beginning of this century were in the boreal regions and on the relatively infertile soils of the humid tropics.

27. In the last half century, this process of forest removal has accelerated in the humid tropics, largely due to the introduction of new technologies for land clearance and agriculture and to the suppression of disease. In almost all instances, forest clearing for agriculture has been deliberate and has been looked upon as advancing possibilities for development, either by increasing food security or providing cash crops to fuel economic development. In many cases, such expectations have been realized, but there have also been many cases in which the forest was removed in exchange for a form of land use that has proved unsustainable or disastrous. Until very recently, no consideration was given to the conservation of genetic diversity in land to be transformed for agriculture, human settlement or major works of infrastructure, and surprisingly little consideration was given even to the conservation of soil and water.

28. In historical terms, much of this forest replacement has proved socially and economically beneficial; equally, much has proved unwise and harmful. In hindsight, much might have been carried out in different places, in different ways and for different purposes. In some parts of the world, forests are returning. In the eastern United States of America and parts of the Mediterranean, for example, natural secondary forest is returning spontaneously,

mainly as economically marginal agricultural and grazing land is abandoned, and as the social priorities of the inhabitants change. In other parts of the world, tree cover (though not natural forest) is being deliberately introduced in the form of forest plantations, plantations of tree cash crops, such as rubber, oil palm and fruit trees, and farm gardens. These are often productive and make effective use of land, but some are criticized because they replace other ecosystems of high ecological or social value. As indicated above, the arguments surrounding deforestation and reforestation are not simple; the questions are not about whether they take place but about their details: where, how fast and for what purpose. The conclusion is clear: forest replacement should be deliberate and controlled. It is possible, though unlikely, that unplanned replacement might not be harmful under certain circumstances, but this is a risk that no country can now afford to take, which emphasizes the necessity and benefits of developing national forest and land-use strategies.

29. Different countries have very different forest endowments and potentialities. Some occupy soils that are inherently very fertile and have high agricultural potential; others do not. Some forest types are of much greater relative importance for the biodiversity they contain; others are not. Some countries have large areas of erodible or fragile soils; others do not. No overall generalizations can be made about the best allocation of forest lands for the long-term optimum provision of goods and services.

2. Forest modification

30. The human modification of forest and other ecosystems has taken place during the whole of human history and prehistory. It has taken several forms: the careful enrichment of natural ecosystems to provide greater human benefit; their sustainable management to provide a continuous flow of benefits; the short-term overexploitation of certain products leading to the long-term depletion of the ecosystem; a fluctuation between these, and especially between overexploitation and neglect; and, more recently, the damage caused by pollution. Although exact quantitative evidence is difficult to collect, there seems no doubt that large areas of forest and woody ecosystems are currently being degraded (according to all the identified criteria for sustainability) by various combinations of cutting, grazing, collecting, hunting, fire and injudicious cultivation.

31. Several points need to be made at this juncture:

(a) Ecosystems can recover from most kinds of modification, provided that such modification has not been too extreme (irreversible) and they are given time for recovery free from further disturbance;

(b) Such recovery is a rare occurrence because in most parts of the world opposing pressures of every kind are increasing inexorably;

(c) However good the management, it is not possible to maximize all benefits to society all the time: choices must be made;

(d) The degradation of forest ecosystems invariably leads to a loss of potential, and in extreme instances is tantamount to deforestation.

3. Shifting agriculture

32. Intermediate between "modification" and "replacement" are shifting and migratory cultivation; they are sometimes one, sometimes the other and sometimes a combination of both. Their effect depends on the detail and sequence of the practices adopted. At best, they can lead to a sustainable form of forest management involving a rotational succession of vegetation that includes secondary forest enriched with many useful species and supports local human requirements. At worst, such practices can lead to extreme degradation and loss of values at all levels.

B. Distinguishing between direct and underlying causes of changes in forest cover

33. Deforestation and forest degradation can be attributed to many different causes. Some causes operate directly on the forest itself and are often easily recognizable in the field: these are referred to as "direct causes". Behind these direct causes, however, may lie a whole sequence of causes, each more indirect or remote than the one which precedes it; these are referred to as "underlying causes". Some underlying causes can be clearly demonstrated to have some influence on the direct causes; in others the influence is less immediate. Even further removed from underlying causes are the prevailing conditions that may make it more likely for deforestation and forest degradation to occur; these are much more difficult to identify with certainty, and often interact and reinforce each other. For example, the removal of an excessive number of trees (the direct cause) may be caused by illegal logging; the illegal logging may be due in turn to ineffective control by a forest department, itself caused by an inadequate budget; finally, predisposing conditions, if any, might be a combination of poor economic growth, civil unrest, lack of employment opportunities etc. These are all underlying causes, some occurring earlier in the chain of causation than others (see boxes 2, 3 and 4).

34. In some instances, it may prove possible to trace a reliable chain of causation, although this becomes increasingly complicated and difficult the further one moves away from direct causes.

35. There are analogies with human health that are useful when it comes to considering treatment: the symptoms of an infectious disease may be easy to identify, and once they are identified, it is often possible to prescribe a precise treatment to effect a cure or at least a temporary respite. But the underlying causes may be, for example, bad hygiene, malnutrition or overcrowding, which require much more general and long-term measures, or they may be institutional, such as poor health services or the ineffective distribution of drugs etc. In such complicated situations, it is important to focus attention on the factors that are truly limiting and that will respond well to treatment.

Box 2. Some examples illustrating the difference between direct and underlying causes of deforestation and forest degradation. a/

Direct causes	Indirect causes
LAND USE CONVERSION TO	POPULATION INCREASE
Subsistence agriculture	Underlying, natural increases
Cash crop/plantation agriculture	Migration, resettlement
Cattle ranching	
Other developments, such as mining and dams	POVERTY
Urban development	INTERNATIONAL ECONOMICS
Infrastructure	Debt and macroeconomic adjustment
	Profit seeking/"free riding"
OVEREXPLOITATION OF FORESTS	
Timber	POLICY FAILURES
Fuelwood	Roads
Non-wood forest products	Subsidies for land use conversion or competing land uses
ENVIRONMENTAL (NATURAL AND ANTHROPOGENIC)	Migration and colonization
Climate extremes (hurricanes, drought, fire etc.)	Underpriced forest goods
Floods, landslides	MARKET FAILURES
Pollution	Failure to capture "public good" aspects of forests
Pests	
	CIVIL UNREST
	Destruction of vegetation
	Refugees and social upheaval

a/ No order of importance is implied, since this varies with different circumstances.

1. Direct causes

36. The direct causes for the replacement of forests by non-forests are primarily the clearing of land for other uses, such as agriculture or construction, and naturally occurring extreme events, such as flooding, landslides and fires. Forest can also be replaced by non-forests if forest modification is carried to such extremes that forest regeneration becomes impossible.

37. There are many direct causes of modifications that can be accurately described as forest degradation, such as:

(a) Harvesting of timber, fuelwood or game above the capacity of the forest ecosystem to replace the quantities extracted;

(b) Excessive selectivity of species, sizes and form cut;

(c) Overgrazing;

(d) Air pollution;

(e) Pollution of forest watercourses;

(f) Soil erosion within the forest;

(g) Anthropogenic fires;

(h) Depletion of biodiversity;

(i) Introduced disease or pest species.

38. It is a combination of the frequency and intensity of human intervention that determines how seriously the forest is modified. Repeated low-level harvesting of certain types of game may lead to no significant harm, but successive timber harvesting at short intervals in tropical moist forest will modify the forest significantly, even if the harvesting is at low intensity, because of excessive canopy opening and site damage during felling and extraction. Even the overcutting of a forest for timber may do no lasting damage if it is followed by a sufficiently long period of recovery. Similar considerations apply to most forms of degradation. Occasional misuse may cause no permanent damage; continued misuse most certainly does and may be irreversible, leading to total forest loss.

2. Underlying causes

39. Underlying causes close to direct causes may be fairly easy to recognize, but each direct cause is more often than not linked to several underlying causes that are often interrelated. Examples of such causes are:

(a) National policies;

(b) Failures of policy or planning;

(c) Insecurity of tenure;

(d) Absence of alternative sources of forest goods and services or substitutes for them;

(e) Failure of regulation or control;

(f) Land speculation;

(g) The temptation of a profitable market;

(h) Absence of employment;

(i) Land hunger;

(j) Displacement of populations;

(k) Farming failure;

(l) Improved accessibility;

(m) Displacement of populations by other land uses;

(n) Burning for cultivation or improved grazing;

(o) Development pressures;

(p) Greed and corruption;

(q) Availability of new technologies;

(r) Unwise intensification of land use;

(s) Introduction of new species;

(t) Poor plant quarantine;

(u) Lack of information, or ignorance.

40. It is at this level that the most obvious limiting factors are often found. This is often, therefore, the level at which action is likely to be most effective (see sect. III below for illustrations).

41. Underlying causes are far more complex and controversial than direct causes. Population growth, macroeconomic factors (such as indebtedness), international trade and exchange rates, and government policies and microeconomic factors are all being blamed to some degree for the excessive rates of deforestation now being experienced in many countries. Many studies have examined the impacts of particular factors on the exploitation of forests in individual countries; when the interactions between different factors are tested across a range of countries to try to identify causal relationships, however, the picture becomes far less clear.

Population

42. Increase in human population is often cited as a major underlying cause of deforestation. The interactions between population and agriculture are certainly crucial in this respect and will continue to be so in the future with world population projected to increase from 5.7 billion in 1995 to 9.8 billion in 2050. However, it should be recognized that growing numbers of people also place increasing demands upon all the other goods and services provided by forests. Population and consumption patterns in the richer countries with low forest cover also create higher demands and affect markets for forest products

from the forest-rich countries. The implication of changing consumption patterns of forest products for forest replacement and modification, as well as the level of implementation of sustainable forest management, is an important issue that is under review in a study that was proposed by the Government of Norway at the first session of the Panel on the subject "Long-term trends and prospects in supply and demand for wood products, and possible implications for sustainable forest management"; the study will be before the Panel at its third session. Increased economic development in some parts of the world will undoubtedly lead to higher consumption of forest products and services. It will be crucial from a resource-supply-planning point of view to develop forest and land-use strategies based on projections that are as reliable as possible. In contrast to agriculture, timber requires long lead times - sometimes a number of generations - to increase supply.

43. The relationship between population and the expansion or intensification of agriculture is very complex, and varies with time and circumstance. Although agricultural expansion may be the initial response to population pressure, intensification occurs if access to land becomes more difficult or only very marginal areas remain. Both processes can happen, perhaps even simultaneously, and it is not fully understood what factors determine which response in any given circumstances. For example, if global figures on the yield and area of cereal cultivation are examined in relationship to population, then both processes are evident. In those parts of the world that still have large reserves of land and low population density, a big share of the increase in food production since 1961 is due to expansion of the area of cultivation, by no less than 51 per cent in Africa. But in regions with the smallest land reserves and highest population densities, most of the increased production over that period came from yield increases. According to observations, growth in the area of cereal cultivation tends to be fastest in areas of fastest population growth; by contrast, growth in yields is slowest where population growth is fastest, and fastest where population growth is slowest. Thus, population growth does not stimulate yield increase until land shortages begin to develop and accessible forest is cleared.

44. The next phase, however, may be an increase in tree cover, which may take place in one of two ways: either as a result of deliberate reforestation (establishing trees where required in appropriate places in a more densely populated landscape), or through the recolonization by trees of land left empty as people migrate to urban centres. Examples of the former are the recent history of northern Europe and of China, examples of the latter that of the United States and certain parts of the Mediterranean. This process is also under way in certain parts of Kenya, a relatively densely populated developing country.

45. In general then, the evidence linking overall increases in the human population and the rate of deforestation is mixed, and although it would seem reasonable to expect that as more people require more food the requirement for more land results in less forest, this is not always the case. A number of studies have tested various different indicators of population, such as growth rates and rural population density, and the results across countries are by no means conclusive. Population pressure is certainly one factor in the deforestation equation but its effects differ in different circumstances and in

response to other factors. For example, if combined with open access, asymmetric tenure and commercialization linked to increasing international demands, population growth leads to considerably faster, even accelerating deforestation compared with population growth alone, whereas population linked to the creation of wealth or to increasing urbanization may produce the opposite effect.

Economic, market and intervention distortions

46. Conventional economic approaches to the economic valuation of forests fail to account for the role played by non-timber forest products and services in decisions about forest management and investment. In many cases, the only product of tropical forests that is considered of economic value is the timber produced, whereas a whole range of non-timber forest products, including fruits, latex and fibres, as well as environmental and ecological services and functions, such as soil protection, water cycling and carbon storage, are not valued (see table 1).

47. Economic distortions have been used to explain excessively high rates of forest destruction. Three types can be distinguished: local market failure, global appropriation failure and intervention failure.

48. Local market failure is the classic economic case of underinvestment, in which market forces are not able to secure the economically correct balance of land conversion and forest conservation. An underlying assumption, of course, is that there is an economically optimum rate of deforestation, which is not zero. Local market failure arises because those who convert the land do not have to compensate those who suffer the social and environmental consequences of that conversion, such as increased pollution and sedimentation of waters caused by deforestation. Possible solutions are well known and include such measures as enacting a tax on land conversion, zoning to restrict detrimental land uses and establishing environmental standards.

49. The rate of return of forest conservation is distorted by what economists call "missing markets". What this means in the tropical forest context is that systems of habitat and species are serving valuable functions that are not marketed. Effectively, then, no one values such functions because there is no obvious mechanism for capturing their values. Local market failure describes this phenomenon within the context of the country or local area, but there are missing global markets as well, illustrated by the example of the value of carbon storage by forests.

50. Intervention failure or ill-conceived deliberate intervention by Governments in the workings of market forces, with disastrous effects on a particular sector of the economy, can coexist with market failure. Examples of intervention that have in some cases had detrimental implications for sustainable forest management are:

(a) Subsidies to forest conversion for agriculture and livestock production;

(b) Insufficient tax levels for logging companies, thus giving them an incentive to expand their activities even further;

(c) Encouragement (such as by subsidies or trade protectionism) of inefficient domestic wood-processing industries, which effectively raises the ratio of logs and hence deforestation to wood product, and so on.

51. Intervention distorts the competitive playing field; Governments effectively subsidize the rate of return of land conversion or bad forestry practice, tilting the economic balance against conservation and the sustainable use of forests.

Macroeconomic policies: debt and structural adjustment

52. It is often postulated that the huge level of external debt that has burdened many developing countries since the mid-1970s has contributed to decisions to replace forests.

53. The mechanisms by which this is said to occur are:

(a) In creating high domestic demand for foreign exchange to pay back debt, which is satisfied through the export of timber and other internationally tradeable products;

(b) In creating a macroeconomic environment that is generally unfavourable to economic growth, thus forcing people into the extensive use of marginal lands;

(c) By forcing Governments into a position in which they reduce expenditure, especially on environmental protection and other services.

54. Such mechanisms are by no means straightforward, however, and any simple correlation between indebtedness and deforestation rates is spurious, due to the effects of scale. For example, some countries have high levels of both debt and deforestation; yet when these variables are standardized and measured on a per capita basis, there is no correlation across countries between debt and deforestation.

55. Confronted with falling living standards, an indebted nation may find it preferable to release resources that were previously devoted to environmental protection for the purpose of boosting production. Debt may therefore have a primarily indirect effect on rates of deforestation by encouraging so-called myopic behaviour, in which deforestation accelerates beyond an optimal level to generate income in order to meet short-term needs at the expense of future consumption.

56. An alternative explanation, however, is that debt and deforestation are symptoms of the same myopia, with political instability as a probable source; again, studies present contradictory results. The role of structural adjustment programmes (SAPs) in accelerating deforestation has been questioned. The empirical evidence for this is mixed, however, and the effects of policies depend on the exact package of measures adopted. For example, policies that

remove subsidies from farm inputs, such as pesticides and fertilizers, or that tax inputs may encourage the expansion rather than the intensification of land use. This issue highlights how policies designed to improve economic performance in one sector of the economy (for example, smallholder production of export crops) may have unwelcome side-effects in another (deforestation). While conventional wisdom and proponents of SAPs maintain that stabilization and adjustment programmes can also benefit environmental management in so far as they improve macroeconomic stability, lengthen planning horizons and improve the workings of the price mechanism, experience to date is more varied: in many cases, their effects on forest management have proved negative. Much criticism of SAPs has also focused on their effects on income distribution and the poorer sections of the population in developing countries, effects that are also likely to bring about deforestation through links with poverty and landlessness. There is evidently a need for complimentary policies to deal with such side-effects.

Poverty

57. Poverty is often blamed as a blanket underlying cause for the unsustainable management of forests and trees, as well as of other natural resources. The impact of poverty is felt at a number of different levels, individually and locally, collectively, and nationally and regionally. However, the over-generalization of poverty as an underlying cause of unsustainable exploitation does not hold true, particularly since not all changes occur in poor countries, nor are poor people the main agents of change. Poverty is manifest in many different ways and has a number of different dimensions. At the macroeconomic level, the relative wealth of countries is conventionally measured in gross national product (GNP) or gross domestic product (GDP), but there is little consistent correlation demonstrated between GNP and rate of forest conversion.

58. Within countries, per capita GNP or GDP is often used as a proxy or measure of comparative wealth. In this respect, evidence suggests that increases in per capita income have two opposing effects on deforestation. First, they lead to rises in per capita food consumption and demand for traded food, which increases deforestation rates because of agricultural land expansion. Second, they also improve the ability to invest in intensive permanent agriculture that is capable of larger yields per hectare, which may offset the first effect. In reality, what often happens is that within the same country different regions may experience these effects differentially, so that within one country the two effects will occur simultaneously. There are a number of difficulties in using per capita income as a proxy for poverty, however, especially when it is also influenced by such important issues as access and rights to resources, such as forests and trees, and to distributional resources.

59. Impoverished people may rely directly on forests and trees to support their livelihoods; the direct uses identified in table 1 may be particularly important for poor people in poor countries. Forests may provide vital resources for people who are landless or displaced, especially in times of contingency or in a difficult season. The way in which people manage these resources will have much to do with their access and property rights, as well as the distribution of the benefits of resource utilization, all of which constitute other dimensions of poverty. Poverty in this context is perhaps best viewed as a shortage of options that may force people into managing natural resources, including

forests, in less than optimal ways, often to provide for short-term needs rather than more long-term and sustainable options.

The timber trade and the industrial use of wood

60. The issue of timber trade will be discussed in detail under programme element IV (see E/CN.17/IPF/1996/11); it is also briefly discussed here in the context of its influence on the rate of timber extraction for industrial purposes and on other direct and underlying causes of deforestation and degradation.

61. International trade in timber is often cited as an underlying cause of deforestation and forest degradation, especially in the humid tropical and boreal regions. The extraction of timber is certainly a direct cause of forest modification and, when conducted badly or to excess, can be a cause of forest degradation. Indeed, the existence of profitable timber markets may provide both a temptation for such overexploitation and the conditions in which it can take place.

62. But timber is an important raw material based on an essentially renewable resources; therefore, timber trade can make a contribution to sustainable development. It can be argued that the world's requirements for timber could be met from a very much smaller area of forest plantations, thus leaving natural forests unexploited. This is theoretically true, and there is undoubtedly a case for meeting some of these requirements from well-sited and well-planned plantations. Trees outside forests and farm forestry can also make a contribution. In any case, the management of natural forest for timber, if carried out sustainably, can make an important lasting contribution to both national economies and local livelihoods, and can provide a direct financial incentive to stem deforestation and forest degradation.

63. If current developments to encourage a market in sustainably produced timber are successful, international trade in timber could become a powerful deterrent to forest degradation or injudicious deforestation.

Civil unrest

64. Civil unrest may be either a direct or an underlying cause of the destruction and degradation of forest. It may affect forests in a number of ways, through the direct destruction of vegetation, trees and ground cover; as a result of mass movements of people, either as refugees fleeing conflict, or due to forced migration or resettlement; as a result of general lawlessness and unregulated exploitation of resources; and through the massive use of timber. Such effects operate at local or regional levels and may also occur across country boundaries, especially when people flee from one country to another.

III. APPROACHES

65. This section attempts to develop a diagnostic framework for assisting countries in diagnosing the causes of damage to their own forests at any particular time. The first stage in this process is the identification of direct causes of actual phenomena in the field.

66. Once the direct causes have been identified, the next stage is to try to follow the chain of causation further. The aim of such analysis should be to detect, in the chain of causation, the factors that are most significantly limiting progress towards the optimum, and to direct attention towards them. These may prove to be at any point on the chain, from a very direct cause to one of the more remote underlying causes, and they may operate at various levels, local, national, regional or international. Unless a specific analysis of this kind is carried out, conclusions are likely to be spurious; the more remote the cause, the greater the danger of drawing false conclusions about it, as may be seen from the above discussion of underlying causes.

67. The first stage in such a process is to link direct with underlying causes, as illustrated in table 4, in which many of the direct causes of deforestation and forest degradation are identified and are linked to a selection of the recognized underlying causes that have been identified in various parts of the world. Table 4 is only intended to provide an illustration of the kind of analysis that could be prepared in any country in an attempt to diagnose the reasons for forest decline; the analysis of any given country would contain fewer positive relationships, since many of these are highly site-specific. The more linkages between direct and underlying causes, the more useful the analysis. For example, timber harvesting damage might be linked to the following underlying causes: harvesting beyond annual allowable cut; high-grading; re-entry; illegal logging; bad road planning and construction; mismanaged extraction; overhunting; local pollution; and genetic erosion (for a more complete list of underlying causes, see para. 39 above).

Table 4. Diagnostic framework: illustration of the relation between selected direct and underlying causes of deforestation and forest degradation

	Underlying causes							
	1	2	3	4	5	6	7	8
Direct causes								
Replacement								
By commercial plantations	X					X	X	
Planned agricultural expansion	X	X				X	X	
Pasture expansion	X	X				X		
Spontaneous colonization		X	X	X		X	X	X
New infrastructure						X		
Shifting agriculture			X	X				X
Modification								
Timber harvesting damage	X		X		X		X	
Overgrazing			X		X			
Overcutting for fuel			X		X			
Excessive burning				X	X			
Pests or diseases					X			
Industrial pollution					X		X	

Key

1 Economic and market distortions
2 Policy distortions, particularly inducements for unsustainable exploitation and land speculation
3 Insecurity of tenure or lack of clear property rights
4 Lack of livelihood opportunities
5 Government failures or deficiencies in intervention or enforcement
6 Infrastructural, industrial or communications developments
7 New technologies
8 Population pressures causing land hunger

68. Boxes 3 and 4 show how this kind of analysis can be applied in some hypothetical examples of countries with different forest conditions. Although the direct causes and successive groups of underlying causes of changes in forest cover are shown as a simple succession, the situation is rarely as straightforward as this; there are many interrelationships and mutual influences. It should be apparent from these examples that the differences among countries are at least as significant as the similarities.

Box 3. Illustrations of analysis of direct and underlying causes of changes in forest cover, shown in simple succession

Country A	Country B
Symptoms: Extensive reduction in area of forest	Symptoms: Increase in area of forested land and reversal of degradation (woody cover extending into previously grazed and cultivated lands)
Direct cause: Planned transference of large areas to tree crops	Direct causes: Reduced grazing Retreat of cultivation Reduced demand for fuel wood
Underlying causes: Provision of disposable income to rural population Cash crops for export in order to fuel development	Underlying causes: Consistent forest policy with strong conservation bias Strong professional department
related to	related to
Market pull for both cash crops and timber Deliberate, planned government policy to industrialize	Concentration on high-value agricultural crops Use of kerosene, electrification, solar energy Strong public support for conservation forestry Good fire control
	related to
	Advanced irrigation systems Deliberate energy policy Alternative employment Higher disposable incomes
	related to
	Good agricultural markets Revenue from tourism

Box 4: Further illustrations of analysis of direct and underlying causes of changes in forest cover, shown in simple succession

Country C	Country D
Symptoms: Pronounced forest degradation (reduced productivity, extensive logging damage, severe erosion, social stress and considerable reduction of biological diversity	Symptoms: Reduction in area of forest
Direct cause: Excessive and careless extraction of timber	Direct cause: Expansion of industrial agriculture for cash crops (soya, sugar) Agricultural expansion into forest areas
Underlying causes: Lack of regulation and control Nature of concession policy Lack of consultation with local people Delays in establishing permanent forest estate and protected areas	Underlying causes: Policy of agricultural expansion (some good, some bad) Policy of giving titles after land clearing Policy of resettlement Spontaneous migration
related to	related to
Political nature of concessions Shortage of professional staff Little consideration for local sensibilities Inadequate use of research findings	Agricultural development for national development Deficient land-use policies Settlement after land reform Search for income and food security Alternatives for coca cultivation
related to	related to
Unfavourable political climate Official manpower ceiling Shortage of government finance Agricultural and resettlement policies	Rural poverty Undervaluation of the forest resource Collapse of mining International pressure against cultivation of illicit drugs Land speculation Shortage of alternative employment
related to	related to
Federal-state relations Strong market pull Timber used as springboard for development Provision of employment	Lack of finance Legislative vacuum Shortage of policy and of administrative structures Weakness of education and research

IV. INSTITUTIONS AND RESOURCES: EXISTING INFORMATION

A. Institutions and resources

69. The present report has highlighted a number of difficulties in making an effective diagnosis of the causes of damaging changes to the world's forest cover. First, in order to decide whether the replacement or modification of forest is or is not acceptable, it is necessary to have policies in place that define how a country wishes to optimize the use of its forests. Second, each country needs to have institutions that are able to judge when management diverges from such policies and are capable of taking appropriate corrective steps. This leads to the further difficulty that the connections between direct and underlying causes of changes in forest cover are not straightforward, suggesting that corrective action may lie outside the conventional remit of existing institutions.

B. Measurement of forest cover

70. The issue of assessment and criteria and indicators will be part of the discussions under element III.1 of the programme of work of the Panel, which is scheduled for substantive discussion at its current session (see E/CN.17/IPF/1996/6), and of element III.2, which is scheduled for substantive discussion at its third session.

71. FAO studies have shown that forest replacement is in principle measurable, especially given recent technological developments. Improvements now being considered will enhance completeness, comparability and reliability. Degradation, on the other hand, cannot yet be measured with any precision. The various criteria and indicators that are being identified and refined in the Montreal and Helsinki processes mark an attempt to come to grips with this problem, as does the approach to forest resource accounting that was developed by IIED for ITTO and is now being implemented or considered in some countries. Ideally, it will eventually be possible to measure progress towards or decline away from sustainable forest management. Essential criteria common to all definitions (even if expressed in different terms) are: biological diversity; the productive capacity of forest ecosystems; forest ecosystem health and vitality; soil and water resources; the forest contribution to global carbon cycles; and long-term multiple socio-economic benefits.

72. However, one conclusion that has emerged from the international discussion to date on this topic is that although the same criteria can be applied to all types of forest, this is not the case for indicators: their choice will certainly have to be specific to the type of forest and the local conditions of land use and forest management. As a result, it will be extremely difficult to make global generalizations about the extent and rate at which forests are being modified, which partly explains why, although many attempts have been made to analyse the causes of deforestation, especially in the tropics, such attempts have not been altogether successful.

73. Good decisions depend upon reliable information in a number of fields, but such information is often lacking. There is a need for timely and accurate information which is strictly relevant to the decisions that must be taken.

V. CONCLUSIONS AND PRELIMINARY PROPOSALS FOR ACTION

A. Conclusions

74. The analysis conducted in the present report leads to the following conclusions:

(a) Deforestation and forest degradation pose a serious problem in some parts of the world, but not all changes in forest cover are necessarily harmful. It is preferable to adopt a more focused approach that concentrates on reversing the most damaging processes and promoting the most effectively beneficial ones;

(b) Although there are relatively accurate statistics about changes in forest cover, there is a severe lack of information about forest quality, which is particularly troubling since many of the most serious unplanned changes in forests concern quality rather than quantity;

(c) The values given to goods and services provided by forest are characterized by the following:

(i) Their importance will vary depending on forest type;

(ii) There will be trade-offs or even conflicts between how such goods and services could be used;

(iii) They will change over time and with the needs and development paths of countries;

(iv) They depend on the emphasis that Governments give to the role of forest in the national economy;

(v) The methodologies used for local and national level valuation are highly dependent on accurate assessment and data;

(d) It is only possible to decide what changes are or are not harmful against a background of national policies that make a best judgement of optimum forest cover (how much, where and of what kind) in order to meet most effectively diverse needs for forest goods and services. Policies for forests (and trees outside forests) need to be consistent with overall national economic, land use and sustainable development policies;

(e) There are many discouragements to sustainable forest management, including economic distortions, such as the undervaluation and underpricing of particular types of timber and of the services provided by healthy forest ecosystems; the failure of national institutions to exercise stewardship over their forest resources; prevailing systems of property rights; the conditions under which concessions are awarded and renewed; and inequities in the

distribution of benefits. Cross-sectoral issues and the international linkages brought about by macroeconomic policies are both important;

(f) Examples of corrective measures to inhibit deforestation and degradation are enacting a tax on land conversion, zoning to restrict detrimental land uses and establishing higher environmental standards;

(g) The links between harmful changes in forest cover and their direct and underlying causes are very complex. Even if there are global dimensions to this problem, they vary greatly from country to country and are not susceptible to simple generalization. There are therefore great dangers in basing policy prescriptions on such generalizations;

(h) Instead of attempting generalizations, therefore, the proposed diagnostic tool can enable countries to trace the chains of causation that affect them, can identify limiting factors and opportunities for effective intervention, and can help them to identify areas in which such limiting factors and interventions have been successful, thus enabling countries to build on their strengths and existing achievements;

(i) It may be found that the most appropriate action will be at any one of a number or levels, i.e., local, national, regional or global;

(j) An important issue is the need for communication and collaboration among relevant individuals, agencies and institutions in their different areas of operation. This should lead to a clearer allocation of resources both nationally and internationally;

(k) Some causes of deforestation and forest degradation lie outside the forest sector and beyond national boundaries. The final recommendations of the Panel could be particularly useful and effective in addressing such causes.

B. Preliminary proposals for action

75. The Panel may wish to note the following areas that require priority attention:

(a) Inclusion in national forest and land-use plans of targets on the optimum forest cover and utilization - how much, where, what kind and for what - that reflect the whole range of functions that forest perform;

(b) The desirability of plans for forest replacement to be deliberate and controlled;

(c) Review of the policies and interventions that have proven detrimental to, as well as those policies that have proven to work in favour of, the management, conservation and sustainable development of forests;

(d) The need for a set of national case studies illustrating the use of the diagnostic tool so as to enhance the understanding of the underlying causes of deforestation and forest degradation;

(e) The need to include information on forest-quality changes in forest assessments;

(f) The need for open access to timely and reliable databases on forest replacement and modification;

(g) The need for increased human and institutional capacity for forest policy analysis and formulation, forest assessment, monitoring and valuation as well as for the collection and dissemination of information;

(h) Enhanced communication and collaboration among individuals, agencies and institutions at all levels - local, national, regional and global - in order to achieve a clearer national and international allocation of resources.

76. The Panel may wish to request its secretariat to take into account current and future discussions on other relevant elements of its programme of work, in particular elements I.1, III.1, III.2 and IV, as well as government-sponsored initiatives under way in support of element I.2, while preparing for discussion of the underlying causes of deforestation and forest degradation at its third session and final consideration at its fourth session.